

*as
cont'd*
modifications may be made to the above without departing from the spirit of the invention, and that the scope of the above invention is to be limited only by the claims appended hereto.*w*

IN THE ABSTRACT

Please delete the Abstract and replace with the following:

ab
A method for applying a digital watermark to a content signal is disclosed. In accordance with such a method, a watermarking key is identified. The watermarking key includes a binary sequence and information describing application of that binary sequence to the content signal. The digital watermark is then encoded within the content signal at one or more locations determined by the watermarking key.*m*

IN THE CLAIMS

Please cancel claims 2 to 15 without prejudice or disclaimer of the subject matter thereof.

*claims 16-86 from 7/13/1786
6 Barron
305-1830
and 132*

Please add the following as new claims 16 through 86:

*AT
cont*
16. A method of generating a random key for applying a digital watermark to a content signal, the method comprising the steps of:

generating a random sequence of binary numbers; and
generating information describing the application of the random sequence to the content signal, wherein the information comprises a sample window size, a signal encoding level, and at least one of the following two groups: time delimiters describing segments of the content signal; frequency delimiters describing frequency bands of the content signal.

17. The method of claim 16, wherein the step of generating information comprises:
using human interactive input to generate information describing the application
of the random sequence to the content signal, wherein the information comprises a
sample window size, a signal encoding level, and at least one of the following two
groups: time delimiters describing segments of the content signal; frequency delimiters
describing frequency bands of the content signal.

18. The method of claim 16, wherein the step of generating information comprises:
creating at least one graphical representation of the content stream in at least one
of the time domain and the frequency domain; and
using the at least one graphical representation to generate information describing
the application of the random sequence to the content signal, wherein the information
comprises a sample window size, a signal encoding level, and at least one of the
following two groups: time delimiters describing segments of the content signal;
frequency delimiters describing frequency bands of the content signal.

19. The method of claim 18, wherein the step of creating at least one graphical representation
comprises creating graphical representations of the content stream in both the time domain and
the frequency domain.

20. The method of claim 18, wherein the step using the at least one graphical representation
to generate information comprises:
using the at least one graphical representation to provide human interactive input
to generate information describing the application of the random sequence to the content
signal, wherein the information comprises a sample window size, a signal encoding level,

and at least one of the following two groups: time delimiters describing segments of the content signal; frequency delimiters describing frequency bands of the content signal; and wherein the method of claim 18 further comprises:

updating the graphical representations to reflect the human interactive input.

21. The method of claim 16, wherein the step of generating information comprises:

providing at least two sample streams of the content signal for selection;

selecting one of said at least two sample streams of the content signal;

generating information describing the application of the random sequence to the selected sample stream of the content signal, wherein the information comprises a sample window size, a signal encoding level, and at least one of the following two groups: time delimiters describing segments of the content signal; frequency delimiters describing frequency bands of the content signal.

22. The method of claim 16, wherein the step of generating a random sequence comprises:

generating a pseudo random sequence of binary numbers.

23. The method of claim 16, wherein the step of generating the random sequence comprises:

- (a) collecting an initial series of random or pseudo random bits;
- (b) processing the initial series of random or pseudo random bits through a secure one-way hash function;
- (c) using the results of the one-way hash function to seed a block encryption cipher loop;
- (d) cycling through the block encryption cipher loop and extracting the least significant bit of each result; and
- (e) concatenating the extracted least significant bits to form a random key sequence.

24. The method of claim 23, wherein the step of collecting an initial series of random or pseudo random bits comprises:

collecting an initial series of bits through human interactive input.

25. The method of claim 16, wherein the step of generating information comprises:

processing the content signal to determine a signal encoding level, to identify time delimiters describing segments of the content signal and to identify frequency delimiters describing frequency bands of the content signal;

generating information describing the application of the random sequence to the content signal using the predetermined signal encoding level, the pre-identified time delimiters and the pre-identified frequency delimiters.

26. The method of claim 25, wherein the step of processing the content signal is accomplished using mathematical calculations based on signal properties of the content signal, said mathematical calculations being selected from the group consisting of: an autocorrelation functions; root mean squared energy calculations; mean squared difference in samples calculations; measurable distortion calculations; spectral energy characteristics; and a combination thereof.

27. The method of claim 16, wherein the step of generating information comprises:

generating information describing the application of the random sequence to the content signal, wherein the information comprises a sample window size, a signal encoding level, channel utilization information, and at least one of the following two groups: time delimiters describing segments of the content signal; frequency delimiters describing frequency bands of the content signal.

28. The method of claim 16, wherein the step of generating a random sequence of binary numbers comprises generating a plurality of sequences of binary numbers, and wherein the step of generating information comprises:

processing the content signal to divide the content signal into a plurality of channels;

processing each of the plurality of channels to determine a signal encoding level, to identify time delimiters describing segments of the content signal, to identify frequency delimiters describing frequency bands of the content signal; and

generating information describing the application of one of the plurality of sequences to each of the plurality of channels using the predetermined signal encoding level, the pre-identified time delimiters and the pre-identified frequency delimiters for each one of said plurality of channels.

29. The method of claim 16, further comprising:

storing the random sequence of binary numbers and the generated information in a database.

30. The method of claim 16, further comprising:

concatenating the random sequence of binary numbers together with the generated information into a string; and

encrypting the concatenated string; and

storing the encrypted, concatenated string in a database.

31. The method of claim 16, further comprising:

using the generated information to embed at least one watermark into the content signal.

32. The method of claim 31, further comprising:

generating a watermark information signal comprising watermark synchronization information to help locate a watermark in the content signal and information to help assess the validity of said watermark;

placing the watermark information signal within the content signal so as to not interfere with any digital watermarks embedded in the content signal.

33. The method of claim 16, further comprising:

creating a watermark comprising: a title identification; a unit measure; a unit price; a percentage transfer threshold at which liability is incurred to a purchaser; a percent of content transferred; an authorized purchaser identification; a seller account identification; a payment means identification; a sender's digitally signed information indicating percent of content transferred; and a receiver's digitally signed information indicating percent of content received; and

using the generated information to embed the watermark into the content signal.

34. A method of embedding a digital watermark into a content signal, the method comprising the steps of:

generating a random or pseudo-random sequence of binary numbers;

associating with the random or pseudo random sequence, one or more references to encoding functions for encoding at least one watermark into a content signal; and

embedding at least one watermark into a content signal using the referenced encoding functions.

35. The method of claim 34, wherein said one or more references is selected from the group consisting of: integer indices that reference chunks of computer code; alphanumeric strings

which name software modules or code resources; and memory addresses of memory locations wherein software programs reside in a computer memory.

36. The method of claim 35, wherein said one or more references comprise alphanumeric strings which identify software modules that can be used to embed a watermark into a content signal.

37. The method of claim 34, wherein said one or more references is selected from the group consisting of: a encode/decode algorithm which is capable of encoding and decoding bits of information directly to and from the content signal, a function which relates the sequence of binary numbers to the content signal; a function which assesses the frequency content of the content signal before embedding the at least one watermark; a function which is capable of encrypting and decrypting information contained in the at least one watermark, and a function which embeds into the content signal a informational signal which comprises information about the at least one watermark such that the informational signal may be used to correct any errors that may have been introduced into the at least one watermark.

07/2018

38. The method of claim 34, further comprising:

generating a second random or pseudo-random sequence of binary numbers;

associating with the second sequence, one or more references to decoding functions for decoding at least one watermark into a content signal; and

extracting at least one watermark from a content signal using the referenced decoding functions.

39. The method of claim 36, wherein said one or more decoding references comprise alphanumeric strings which identify software modules that can be used to extract a watermark from a content signal.

40. The method of claim 34, further comprising:

storing the random sequence of binary numbers and the generated information in a database.

41. The method of claim 34, further comprising:

concatenating the random sequence of binary numbers together with the generated information into a string; and

encrypting the concatenated string; and

storing the encrypted, concatenated string in a database.

42. The method of claim 34, wherein the content signal is selected from the group consisting of: an audio signal; a video signal; and a still image, and the step of associating comprises:

associating with the random or pseudo random sequence, one or more references to encoding functions specifically designed for encoding at least one watermark into an audio signal, a video signal or a still image.

43. The method of claim 34, wherein the embedding step comprises:

embedding at least one watermark into a content signal using the referenced encoding functions, said at least one watermark comprises distribution restriction information.

44. The method of claim 43, wherein the distribution restriction information comprises one or more of the following: a geographical constraint on distribution; a logical constraint on distribution; a Universal Resource Locator (URL); a telephone number; an Internet Protocol address; an Internet domain name; an e-mail address; and a file name.

45. The method of claim 34, further comprising:

interleaving information about each of said at least one watermarks into the content signal.

46. The method of claim 45 wherein the interleaving is accomplished by placing information about each of said plurality of digital watermarks into specific frequency bands of the content signal.

47. A method of embedding a plurality of digital watermarks into a content signal, the method comprising the steps of:

generating a random or pseudo-random sequence of binary numbers for each of the plurality of digital watermarks to be embedded;

associating each of the random or pseudo random sequences with one or more references to encoding functions for encoding watermarks into a content signal, and with each of the plurality of digital watermarks to be embedded; and

embedding each of the plurality of digital watermarks into the content signal using the referenced encoding functions associated with the respective digital watermark.

48. The method of claim 47, further comprising:

interleaving information about each of said plurality of digital watermarks into the content signal.

49. The method of claim 48 wherein the interleaving is accomplished using functions which operate on the content signal in the time domain.

50. The method of claim 48 wherein the interleaving is accomplished using functions which operate on the content signal in the frequency domain.

51. The method of claim 50 wherein the interleaving is accomplished by placing information about each of said plurality of digital watermarks into specific frequency bands of the content signal.

52. The method of claim 47 further comprising:

generating a decode key for each of the plurality of digital watermarks that was embedded.

53. A method for applying a digital watermark to a content signal comprising the steps of:

- (a) generating a watermarking key comprising a binary sequence and information describing application of the binary sequence to the content signal;
- (b) encoding the digital watermark within the content signal at one or more locations determined by the watermarking key; and
- (c) generating a symmetric key pair associated with the watermarking key.

54. The method of claim 53, wherein the symmetric key pair includes an encode key and a decode key.

55. The method of claim 53, further comprising:

using the decode key to authenticate the encoded digital watermark.

56. The method of claim 53, further comprising:

using the decode key to decode the encoded digital watermark.

57. The method of claim 53, further comprising:

adding a digital signature to the content signal; and

using the decode key to authenticate the digital signature.

58. The method of claim 53, wherein the step of generating a symmetric key pair comprises:

(c) generating a symmetric key pair associated with the watermarking key, said key pair including an encode key and a decode key, said decode key being incapable of decoding the encoded digital watermark.

59. A digital watermarking system for encoding digital watermarks into a content signal, the system comprising:

an input device for receiving the content signal;

a watermark generator to generate at least one watermark to be embedded into the content signal;

a random number generator to generate at least one sequence of random binary numbers;

a function generator which is capable of generating a plurality of encoding functions;

an association device to associate one of said at least one sequence of random binary numbers with at least one of said plurality of encoding functions and with a watermark generated by the watermark generator; and

an encoding device to encode a watermark generated by the watermark generator into the content signal using the functions associated with said watermark.

60. The digital watermarking system of claim 59, further comprising:

a storage device for storing each sequence of random binary numbers that is associated with at least one encoding functions and with a watermark, which association is made by the association device.

61. The digital watermarking system of claim 60 wherein the storage device comprises a database for storing each sequence of random binary numbers that is associated with at least

one encoding functions and with a watermark, which association is made by the association device.

62. The digital watermarking system of claim 59, further comprising:

a decoding device to decode a watermark that has been embedded into the content signal.

63. The digital watermarking system of claim 59, wherein the function generator comprises:

a preprocessor for preprocessing the content signal; and

a function generator which is capable of generating a plurality of encoding functions based upon input received from the preprocessor.

64. The digital watermarking system of claim 63, wherein the preprocessor includes means to select a sample window size for the content signal, a signal encoding level, and at least one of the following two groups: time delimiters describing segments of the content signal; frequency delimiters describing frequency bands of the content signal.

65. The digital watermarking system of claim 59, wherein the association device comprises:

a concatenator to concatenate the random sequence of binary numbers together with at least one of said plurality of encoding functions into an concatenated string;

an encrypting device to encrypt the concatenated string; and

a storage device for storing the encrypted, concatenated string in a database.

66. The digital watermarking system of claim 59, wherein the association device comprises:

means to place information about an embedded watermark into the content signal.

67. The digital watermarking system of claim 59, wherein the association device places information about an embedded watermark into the content signal at a predetermined frequency.

68. The digital watermarking system of claim 59, wherein the function generator comprises:

a processor for processing the content signal;

a display device for displaying information about the processed content signal;

an interface for receiving input from a human operator; and

a function generator which is capable of generating a plurality of encoding functions based upon input received from the interface.

69. The digital watermarking system of claim 63, wherein the interface includes means for the human operator to select a sample window size for the content signal, a signal encoding level, and at least one of the following two groups: time delimiters describing segments of the content signal; frequency delimiters describing frequency bands of the content signal.

70. A digital watermarking system for encoding digital watermarks into a content signal, the system comprising:

an input device for receiving the content signal;

a watermark generator to generate at least one watermark to be embedded into the content signal;

a random number generator to generate at least one sequence of random binary numbers;

a function generator which is capable of generating a plurality of encoding functions;

a watermarking key generator which generates a watermarking key using a sequence of random binary numbers generated by the random number generator and using input from the function generator;

an encoding device to encode a watermark generated by the watermark generator into the content signal using a watermarking key generated by the watermarking key generator.

71. The digital watermarking system of claim 70, wherein the function generator comprises:

a processor for processing the content signal;
a display device for displaying information about the processed content signal;
an interface for receiving input from a human operator; and
a function generator which is capable of generating a plurality of encoding functions based upon input received from the interface.

72. The digital watermarking system of claim 71, wherein the interface includes means for the human operator to select a sample window size for the content signal, a signal encoding level, and at least one of the following two groups: time delimiters describing segments of the content signal; frequency delimiters describing frequency bands of the content signal.

73. The digital watermarking system of claim 70, wherein the function generator comprises:

a processor for processing the content signal;
a display device for displaying at least two sample streams of the content signal for selection;

an interface for wherein a human operator may select one of said at least two sample streams of the content signal, may specify sample window size, signal encoding level, may specify at least one of the following two groups: time delimiters describing segments of the content signal; frequency delimiters describing frequency bands of the content signal; and

a function generator which is capable of generating a plurality of encoding functions based upon input received from the interface.

~~Off~~
~~On~~

74. The digital watermarking system of claim 73, wherein the interface includes means to update the display device to reflect the human interactive input.

75. The digital watermarking system of claim 70, wherein further comprising:
means to place information about an embedded watermark into the content signal.

76. The digital watermarking system of claim 75, wherein the means to place information comprises:
means to place information about an embedded watermark into a predetermined location within the content signal.

77. The digital watermarking system of claim 74, further comprising:
a decoding device to decode a watermark that has been embedded into the content signal.

78. The digital watermarking system of claim 75, further comprising:
a decoding device to that can access the information about an embedded watermark that has been placed within the content signal to authenticate the embedded watermark.

79. A digital watermarking system for encoding and decoding at least one digital watermark within a content signal, the system comprising:

a digital watermark encoder; and

a digital watermark decoder;

said digital watermark encoder and said digital watermark decoder being configured to respectively encode and decode at least one digital watermark using (1) a watermarking key that encodes a watermark into a content signal using a random or pseudo-random binary sequence and (2) an encode and decode pair associated with the watermarking key.

80. The digital watermarking system of claim 79, wherein said digital watermark encoder comprises a first software program, and said digital watermark decoder comprises a second software program, said first program being independent of said second program.

81. The digital watermarking system of claim 79, wherein said digital watermark encoder comprises a first hardware device and said digital watermark decoder comprises a second hardware device, said first hardware device being separate from said second hardware device.

82. The digital watermarking system of claim 79 wherein the digital watermark encoder is capable of encoding a digital watermark using a watermarking key comprising a random sequence of binary numbers and information describing the application of the random sequence to the content signal, wherein the information comprises a sample window size, a signal encoding level, and at least one of the following two groups: time delimiters describing segments of the content signal; frequency delimiters describing frequency bands of the content signal.

83. The digital watermarking system of claim 79, wherein the digital watermark decoder comprises a software decoding key for detecting each digital watermark that has been encoded within a content signal.